9-2010

Elementary and Middle School Science Lesson Plan: Solid, Liquid, Gas, What is it?

Getaway Special Team 2010

Lesson Plan – Elementary and Middle School Science

Unit Theme: States of Matter and Phase Changes
Lesson Title: Solid, Liquid, Gas, What is it?
Grade Level: 3rd-8th
Subject Area: Science
Number of Learners: Entire class
Time Needed: 30-45 minutes

Curriculum

5th Grade Science Core Curriculum

Standard I: Students will understand that chemical and physical changes occur in matter.
Objective 2 – Evaluate evidence that indicates a physical change has occurred.
Objective 3 – Investigate evidence for changes in matter that occur during a chemical reaction.

7th Grade Integrated Science Core Curriculum

Standard I: Students will understand the structure of matter.
Objective 1: Describe the structure of matter in terms of atoms and molecules.
Objective 3: Investigate the motion of particles.

Materials Needed

- Corn starch
- Water
- Baking soda
- Vinegar
- Food coloring
- Beaker
- Legos
- Balloons
- Speaker
- Amplifier
- Tone Generator
- Container for cornstarch and water
- Wooden mixing spoon
- Microgravity and Gravity Boiling of 2010 Experiment Videos
    - Microgravity Link: http://www.youtube.com/watch?v=h9PnK58m0tE
    - Gravity Link: http://www.youtube.com/watch?v=Z-N1j-8tR3s
- GAS Team Summer 2010 NASA Experience Video
    - Link: http://www.youtube.com/watch?v=7xQp8LWcqoE

Learning Objectives

Students will understand that matter has different phases; solid, liquid, and gas. Students will understand when a phase change occurs. They will also be able to distinguish the difference between physical and chemical changes.

Background Knowledge

Teachers understand the difference between a solid, liquid, and gas and understand that solids have the least amount of energy (slowest moving particles) and gases have the most (fastest

moving particles). Understand that matter exists in all three states. Physical change is a change that doesn't alter the substance's chemical identity. One example is water changing from ice to liquid water to steam. Chemical change occurs when chemical bonds are broken and new bonds are formed between different atoms. You can't return it back to the original state. One classic example is fire.

Instructional Procedure

Start the lesson with a mixture of corn starch and water bouncing around on a stereo speaker. Ask the students what they think is happening and then begin the discussion on properties of matter. Teach that the corn starch is a solid and water is a liquid and thus they can act like both a liquid and a solid, known as a non-Newtonian fluid.

Ask students what they know about solids, liquids, and gases. Use various Lego configurations to show how the molecules in solids, liquids, and gases are organized differently. Start by building a set that is compact and the same color, like a rectangle, portraying a solid, where the molecules are close together. Next start pulling Lego pieces off one by one showing that molecules in a liquid have a little more freedom and energy to move around. To demonstrate gas molecules, throw the Legos in the air in all directions. Explain to the students that the molecules in a gas don't want to be next to one another so they disperse in any direction possible. Also explain to the students the different energy levels each phase state has; solids have a low energy, liquids a little more, and gases have the most.

Once the students understand these properties of matter, ask them how matter changes between the different states. Ask them if they know the two different types of changes that can occur. Discuss physical and chemical changes. To demonstrate a physical change, use a solid blue block of Legos. Piece by piece take them apart and explain that the Legos are now a liquid because they have more energy. Finally move the Legos in all directions for a gas. Be sure to discuss and point out that the molecules never changed, just changed phases.

To demonstrate a chemical change, use a red and blue cube set. Explain to the students that the Lego sets are different molecules; the red being a solid (salt) and blue a liquid (water). Then add some energy into the molecules, start to break them apart, and combine both block colors together to form one cube. Explain to the students that the two colored block acts like a liquid solution such as salt water. Finally put more energy into the molecules and pull them apart and spread them out from one another. This is creating a gas and the molecules want to get as far away as they can. It will also be useful to demonstrate this explanation with a cup of water, add the salt so they can see it inside and mix it around so it disappears. Emphasize with a chemical change you can't turn the molecules back to their previous state. You can't turn the salt water back into salt and water. Chemical changes occur when molecules of matter are combined to make a new substance. Some clues to tell if a chemical change has occurred include a change in smell, light or heat is given off, or production of bubbles or gas. Some examples include fire, rust, baking, fall leaves changing color, and moldy cheese.

Next, use the baking soda, vinegar, and balloon to demonstrate all three states of matter, physical change, and a chemical change. Add some vinegar to a beaker and ask the students what type of state it is in. Then add some food coloring and ask the students what type of change has

occurred. It is a physical change because you didn't change the properties of either substance. Next show the students some baking soda and ask what state it is in. Add some baking soda to the vinegar and put a balloon over the beaker opening. This will cause the mixture to react and bubble up causing the balloon to fill up with a gas called carbon dioxide. Ask the students what type of change just occurred and what they think is in the balloon. Be sure they understand it is a gas. This will help them see the change from a solid and liquid state to a gas state. This will also help them understand that although a chemical change has occurred, none of the material that went into the experiment disappeared, it just changed state.

Next ask the students why they think states of matter and phase changes are important. Discuss with them their importance in everyday life. Next ask the students how many of them like macaroni and cheese. Ask them how they make it. This is a perfect lead into boiling water. Ask them why the bubbles go up when they are boiling the water. Discuss with them the impact gravity has on making the bubble go up. Then ask them if they think astronauts like macaroni and cheese. Do you think they can have it in space? Ask them what they think would happen if they tried to make macaroni and cheese in space. Bring out there is no gravity, so the food would do everywhere. Ask them what direction the bubbles go when you don't have gravity. Emphasize the point of them going everywhere.

Ask them why they think boiling in space would be useful. Bring out the usefulness of heat management systems and using it as a source of cooling. This potentially provides assistance for further space exploration. Explain to them that students at USU were wondering its usefulness and explain about the project. Show the students the boiling cube and pass it around. Next show them video footage of the 2010 experiment. Show them boiling in gravity first and ask them which way the bubbles are going. Then show them boiling in microgravity and ask them where those bubbles are going.

Boiling on Earth:
http://www.youtube.com/watch?v=Z-N1j-8tR3s

Boiling in Microgravity:
http://www.youtube.com/watch?v=h9PnK58m0tE

Talk about the research performed, what we have learned, and what we continue to hope to learn. Show the students the NASA team video.
http://www.youtube.com/watch?v=7xQp8LWcqoE

Emphasize that the basic science concepts the students are learning now apply through all of science. Explain that we are using the basic principles of states of matter and phase changes in college research. Wrap up with a few experiences from the trip and promote college and the opportunities you can have. Go Aggies! End with questions.

As the students are dismissed, allow them to touch the cornstarch mixture and feel that it is a solid and a liquid at the same time.

Assessment
Students will provide correct answers to questions asked during the presentation. A run through the experiments again will also give a solidification of their knowledge learned.

Extensions
Using food coloring and water add a few drops of food coloring to water and ask what type of change this is. It is a physical change. Next add bleach. This will clear up the water in a few minutes. Ask what type of change just happened, chemical or physical. This is a chemical change. Ask the students to justify their answers. Next add baking soda to water and ask what type of change, chemical or physical. This is a physical change due to its solubility. Finally add baking soda to vinegar and ask what type of change this is. It is a chemical change. If students are unclear, allow them to perform the experiments themselves to clarify.

Explain to the students what a control factor is in an experiment. Ask the students what they think happens when you bake a loaf of bread and the reaction that takes place. Then have them make four different loaves of bread at home. One with the correct amount of yeast, another with no yeast, another with half the amount of yeast, and the last with double the amount of yeast. Have the students bring the loaves to class and discuss the differences in the loaves due to the various amounts of yeast. Also have them come up with a hypothesis or conclusion for the reaction differences due to the varying amounts of yeast. Discuss the changes that occurred with the ingredients and making the bread.